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*Monday, 5th January 1863.*

PROFESSOR KELLAND, V.P., in the Chair.

The following Communications were read:—

1. Biographical Account of Professor Louis Albert Necker, of Geneva, Honorary Member of the Royal Society of Edinburgh. By David James Forbes, D.C.L., F.R.S., V.P.R.S. Ed., Principal of the United College of St Salvador and St Leonard, in the University of St Andrews.

LOUIS ALBERT NECKER, who died at Portree, in Skye, on the 20th November 1861, aged 76, had been for many years a Foreign Honorary Fellow of the Royal Society of Edinburgh.

His relation to the Royal Society, and to Scotland generally, was, however, far different from what belongs to most honorary members. As a youth, his studies had been pursued at the Edinburgh University. He had received almost his first introductions to society amongst the very best circles which the Scottish capital, in the days of perhaps its highest literary and scientific celebrity, could afford; he visited the Highlands, and even the remoter Hebrides, with an admiring enthusiasm which few native tourists have surpassed. In later life he returned with renewed interest to revisit the scenes where he spent his youth. He not unfrequently attended the meetings of the Royal Society, and occasionally contributed to

its Transactions; and, finally, having made Scotland the country of his adoption, and passed the last twenty-five years of his life almost entirely on its soil, his remains were laid in the churchyard of the remote village of Portree, which had long become his sole residence.

Under all these circumstances, a slight biography of Mr Necker peculiarly merits a place in the Proceedings of the Royal Society. I shall rather endeavour to convey an idea of what our learned and amiable associate really was, derived from my acquaintance with him personally, and through his writings, than to enumerate all the details of his life, which, as in the case of most literary men, was far from eventful.

Louis Albert Necker was born at Geneva on the 10th April 1786. His father, Jacques Necker, was Professor of Botany, and also a councillor of state and syndic of Geneva. This Jacques Necker was nephew of the financier Necker under Louis XVI., and cousin-german of Madame De Staël. Louis Necker was therefore one generation farther removed from those eminent persons. His mother, Albertine de Saussure, daughter of the illustrious Swiss naturalist, was a person of unusual talent, and of the most amiable disposition. His attachment to her throughout her life was of the tenderest and most constant kind. She died in 1841. She is known to the public by her excellent work called "*Education Progressive*," and also by a biographical notice of Madame de Staël. Necker finished his school studies at Geneva in 1800, and entered the *Académie*, where he followed the various courses of the higher studies for four years. In July 1803, in company with his father, he made his first journey into the Alps, commencing with Chamouni, and extending it to Zermatt. I recollect to have seen in the visitors' book at Chamouni Louis Necker's own record of this visit, entered in a boyish hand.

In 1806 Louis Necker proceeded to Edinburgh (being then twenty years of age), for the purpose of prosecuting his studies at the University, and of improving his mind by foreign travel. This was a practice by no means uncommon amongst the educated Genevese of that date, and one which, I am glad to say, continues at the present time. Those who pursued medicine and the physical sciences have especially resorted to Edinburgh. The result has been a very friendly mutual feeling between the Genevese and the Scotch,

which has been constantly experienced not less by those of the one country than of the other. Mutual hospitalities and many valued friendships have been thence derived.

Of such results Necker's was a signal instance. After the age of twenty, Scotland became to him a second fatherland. As became the grandson of De Saussure, he was already conversant with mineralogy and geology; and he could not in all Europe have found a school better fitted to educe his talents than Edinburgh presented at that period. In the University, indeed, under the zealous Jameson, the doctrines of Werner reigned supreme. Yet it was well for a young geologist of that day to become acquainted with his teachings; and in so far as they were overstrained or erroneous, there was an ample corrective in the distinguished school of Huttonians, who then discussed and elucidated the theory of their master, partly in the University, but principally in the hall of the Royal Society, and by their writings. Necker was personally acquainted with Playfair, Sir James Hall, Lord Webb Seymour, Hope, Allan, and others, who met nearly every week at the period of Necker's stay in Edinburgh, to discuss in this Society the theories of geology, and to listen and reply to the less numerous, yet undaunted supporters of Wernerianism, headed by the persevering Jameson. Already, during the winter of 1806-7, Necker had visited the interesting coast of Fife, and the principal islands of the Forth; and under the guidance of Sir James Hall himself had inspected the numerous and interesting geological sections which abound on its southern shore as far as St Abb's Head. At other times he travelled in company with Patrick Neill and others of the Jamesonian school, and had an opportunity of judging impartially the opinions of either party. Of course the discussions of the winter were to be farther pursued in the field during summer; and Necker, nothing loth to judge for himself concerning the facts of which he had become accustomed to hear such conflicting explanations, undertook excursions not only in the geologically interesting neighbourhood of Edinburgh, but to the west of Scotland, and even into the farthest Highlands, then but little visited. The origins of granite and trap were of course the main objects of his search, so far as geology was concerned; and, no doubt by the advice principally of Playfair, who used to call Arran an epitome of the world, one of his early excursions (in May 1807)

was to visit that island, which he appears to have studied with scrupulous care, having spent nine days in the northern and most interesting part of the island. He was accompanied by a fellow-student named Shute. He there became a convert to the igneous theory of granite, and seems to have been among the first to direct attention to the granite veins of Tor-nid-neon, afterwards more carefully explored by Mr James Jardine.\*

On the 6th August 1807, Necker again left Edinburgh to visit Staffa and the Western Highlands. He travelled by Inverary and Oban, and traversing Mull, enjoyed at the small island of Ulva the hospitality of Mr Macdonald of Staffa, with whom he formed a close friendship, and of whose kindness I have heard him speak warmly even in his later years. From Ulva he made two excursions to Staffa, to the geology and mineralogy of which he of course devoted the utmost attention. He next visited the Island of Coll, where he observed traces of the action of the Gulf-stream in the transported seeds and other products of West Indian origin. He crossed to Tiree, with its ornamental marble; on leaving which he was driven back to Coll by stress of weather, but finally reached Eigg, ascended the Scuir, celebrated for its pitchstone, its fossil wood, and for the cavern which was the scene of a well-known historic massacre. Thence he touched at Rum and Canna, carefully visiting what was most interesting in each; crossed to South Uist, and finally to Skye, reaching Talisker on the 23d September. The advanced season of the year compelled him soon to think of returning southwards. After a stay of a few days only, he left Skye with vivid feelings of regret at having obtained only a glance at its noble scenery and interesting mineralogy. Little did he then think that that island should one day be as familiar to him as his native Switzerland, and should, after more than half a century, afford him a final resting-place! He returned to Edinburgh by Inverness, Elgin, and Blair-Athole, without, however, visiting Glen Tilt.

These particulars have been chiefly gathered from a journal of his Tour in Scotland, by Mr Necker, evidently nearly all written at the time, but (with a procrastination which became habitual with him) not published until 1821† (fourteen years later), when

\* A model of these by Jardine is stated by Necker to have been presented to the Royal Society of Edinburgh. I trust it still may be found in their museum.

† *Voyages en Ecosse et aux Isles Hebrides, par L. A. Necker de Saussure,*

the interest of the details was considerably diminished. Perhaps partly from this cause, the circulation of the work was, I believe, not great, and in this country it is certainly much less known than it deserves to be. It is written, for the most part, with great animation, and conveys a lively impression of the literary society of Edinburgh at that day, and of the state of society in the remoter Highlands and Islands, as well among the higher as the lower classes. It includes many excellent descriptions of scenery, and many accurate details of the mineralogy and geology of the places he visited, written evidently in the manner of De Saussure, whose writings were naturally the object of his life-long admiration. Though admitted to the intimate society of many amiable and accomplished families, he exercised a wise discretion in giving no personal details, and he confined his public references to scientific and literary men, whose attainments and opinions were open to the remark of every one. The caution with which he holds the balance between Huttonian and Wernerian doctrines is almost amusing. But though the decidedly Wernerian views of his illustrious grandfather tended, perhaps, more than anything else to secure his favourable mention of Werner's classification of Rocks, and his adoption of his nomenclature, the Huttonian bias of his mind is everywhere visible; and he does not hesitate to declare, that whatever may be the worth of Hutton's Theory of the Earth in its most wide and speculative sense, yet that the facts of geology have been more correctly and impartially stated by his followers than by their opponents.\*

These volumes also show a general acquaintance with other branches of science besides geology, and with literature and art, highly characteristic of the man. Ornithology, in particular, was then and afterwards a favourite study. They contain a great deal on matters connected with the social condition of the country, and its progress in civilisation, and on various questions of the day,

3 vols. 8vo. Geneva, 1821. I may here note, that it is, or was the custom at Geneva, for unmarried men to assume their mother's surname after their own; after marriage, their wife's. Hence, M. Necker is sometimes spoken of as if his family name were De Saussure.

\* Mr Cumming Bruce, M.P., recollects that at this period, Necker "used to express his regret that the party spirit then at its height between the Wernerians and Huttonians did not allow either to give due weight to facts which might have made them more tolerant of each other."

which now, of course, have lost much of their interest, but which mark a very intelligent and acquisitive mind. In particular, it is amusing to notice how his Caledonian enthusiasm every now and then breaks forth in defence of Scotsmen and their country in opposition to what he considered to be unjust English prejudices. He repudiates the idea that Scotland's prosperity was in any material degree due to the Union with England; he despises the sneers of Dr Johnson; and he believes all that reasonably could be believed of the genuineness of Ossian's Poems, a portion of which, moreover, he heard recited by a native of Tiree.

It is easy to believe that a young Swiss, highly intelligent, and animated by sentiments so agreeable to Scotchmen, was warmly welcomed into the best circles of Edinburgh. Among the survivors of those who were then intimate with him, I have received a few slight reminiscences from two,—Mr Charles L. Cumming Bruce, M.P., and Mr James Mackenzie.\* In the families of these two gentlemen he was ever welcome; and his gaiety, intelligence, gentleness, and love of female society, made him a great favourite. Indeed, the domestic pleasures of that early visit made an impression on his mind which was never eclipsed,—which yet possibly tended to throw a shade of gloom over his more advanced years, when, still solitary in the world, the magnetic influence of early scenes and friendships drew him once and again back to his much-loved Scotland. It was at the house of “the *Man of Feeling*” especially, that “he met, and was most intimate with, all that was best and most distinguished in the then charming society of Edinburgh, which consisted, among others, of Dugald Stewart, Playfair, Walter Scott, Jeffrey, Dr Hope, and Lord Webb Seymour, with all of whom his happy temper and *naïve* cheerfulness made him a great favourite. When they took their departure, he used to remain discussing their various characters with the accomplished ladies of the family.”† Mr James Mackenzie kindly informs me that Necker's chief college companion was an intelligent English medical student named Smith, with whom he lodged at first in St James's Square. Previously (no doubt in the winter 1806–7) he lived in the College, in the house of Wilson the janitor.

The travels described in the three volumes I have mentioned

\* Writer to the Signet; a son of the author of the *Man of Feeling*.

† From a letter of Mr Cumming Bruce, whom, later, he visited at Oxford.

seem all to have been performed either in the winter of 1806-7, or in the following summer and autumn. There is no doubt that he passed the succeeding winter in Edinburgh, but then, for a time, we lose trace of him. It appears from a passage in his book (vol. ii. p. 67), that he visited Devonshire and Cornwall in 1809 with geological objects. I cannot be sure whether or not he had previously returned to Geneva. I understand that his home journey took place through Holland, and was not free from embarrassment, owing to the war. In 1808 he was elected a member of the *Société de Physique et d'Histoire Naturelle de Genève*, which seems rather to indicate that he returned home in that year. In 1810 he was appointed, under the French régime, joint Professor of Mineralogy and Geology at Geneva; and became Honorary Professor (under the Swiss Government) in 1817. In both these capacities he delivered various courses of lectures, as well on geology as mineralogy; and his geological excursions with his students are still advantageously recollected.

In 1813 he visited Auvergne, the Vivarais, and the South of France, for geological purposes, and at the same time the Pyrenees, and probably the coasts of Genoa.\* Mr Cumming Bruce's notes give us a glimpse of Necker about this period under a different aspect. "My next salient recollection of him," writes Mr C. Bruce, "presents him to me as 'Minister of Police' on my arrival at Geneva in the early summer of 1814, when I arrived there from Italy. The republic had just effected its restoration, and repudiated its annexation to France. I was stopped at the gates to exhibit my passport, when, to my infinite delight, my friend [Necker] presented himself in uniform,† and you may imagine that my baggage was passed with scant investigation. He consigned it to two attendants, with orders to carry it to Cologny, to which (his father's charming villa) he insisted on my accompanying him; and there, in the enjoyment of the kindest hospitality, rendered more and more agreeable by the charm of his charming mother's society, I remained

\* *Voyages en Ecosse*, tome i. pp. 45 and 215. See also *Etudes sur les Alpes*, p. 363.

† He was in 1815 captain of a company in the *Contingent Genevois*, under General Bachman. I may here add that he was twice a deputy in the *Grand Conseil* of his Canton, and in 1818 was a representative of Geneva at the Swiss Diet.

during six weeks or two months of my stay on the shores of the beautiful lake. In those days we used to call him *Fouché*, in virtue of his office as Minister of Police. I owed to him at that time my introduction to the society of Coppet, and the kind and sustained friendship of Madame de Staël. There, with Schlegel, Sismondi, Dupont, Sir H. and Lady Davy, Lady Charlotte Campbell and her daughter, Louis and I formed two of the *dramatis personæ* in acting little plays arranged by our hostess from the lesser poems of Byron.”\*

I find that in 1820 he made an excursion to Italy. Indeed, he not improbably had passed the previous winter there, though I do not know the occasion. At all events he visited Mount Vesuvius in April; and he then made interesting observations on the dykes or injected lavas of Monte Sōmma, his account of which† still remains classical, and connects itself with his studies of Huttonian geology in Scotland.

In 1821 he at last brought out his work on Scotland, and having thus relieved himself of a task of which he had no doubt long felt the weight, he set himself seriously to what he no doubt considered the main business of his life—the study of the geology of the Alps, in continuation and verification of the labours of his grandfather, De Saussure, whose academic chair he had for some years occupied.‡ He had previously travelled in Switzerland from time to time with geological objects in view, but from and after 1821 (as he himself tells us) he made regularly two annual excursions, one in the early§ part of summer in the lower and outlying parts of the chain, and another towards autumn in the higher Alps. He justly remarks that the importance of the study of the inferior and external parts of the range was at that time not fully appreciated, and still less, perhaps, the excessive fatigue, heat, and even peril, attending the investigation, step by step, of these rugged calcareous mountains, which fully equal in height, even when allowance is made for their elevated bases, the highest mountains of Britain. In all these cases he examined on foot, and step by step, the range of country

\* From a letter of Mr Cumming Bruce.

† *Mem. de la Soc. de Phys. de Genève*, tome ii.

‡ One of his public academical addresses, delivered in 1821, has been preserved (*Bibliothèque Universelle*, 1824).

§ *Etudes Geol. sur les Alpes*. Preface.

within which his special journey was confined, making elaborate notes and drawings on the spot, which he inked in at leisure, thus accumulating a mass of authentic and valuable details, of which unfortunately but a very small part ever saw the light.\* The environs of Geneva and the important and intricate country between its lake and the bases of Mont Blanc, formed the most frequent scene of his geological labours. In 1826 he made a special study of the Valley of Valorsine (near Chamouni), with its interesting granite veins and pudding-stones. It may be conceived with what interest he compared the former traces of the vast upheaving forces which raised the Alps, with those which he had sedulously examined nearly twenty years before in the Isle of Arran.

But his researches were far from confined to his own district of Switzerland and Savoy. He had previously visited the Eastern Alps, including the environs of Trieste, and a great extent of country then almost unknown to geologists, extending southwards nearly to Dalmatia, and northwards to Vienna. Family affairs in part, I believe, directed his course to Trieste, and the visit was repeated for some consecutive years. To connect his studies in the East with those in the Western Alps, he undertook in 1828 a special journey, which lasted from May to September, of part of which he published a brief account (*Etudes Géologiques*, Preface, and *Bibl. Univ.*, Oct. 1829). This last is a paper on the interesting hypersthenic syenite of the Valteline. He started by the Tarentaise, Little St Bernard, and Val d'Aoste, by Val Sesia, along the whole series of the Italian lakes to the Vicentin, and thence to Belluno a Pieve di Cadore, from whence he reached Trieste by the Valley of the Tagliamento. He thence traversed Carniola and Carinthia, entering the Tyrol near Fassa, and pursuing his route by the Stelvio and Valteline, until he regained his former track at Como. In 1829, or subsequently, he returned once again with admirable perseverance to the Alps of Carniola, and those of Istria

\* As an example, I may mention that soon after M. Favre's interesting paper had appeared in 1848, on the Geology of Chamouni, in which he announces the interesting fact that the summit of the Aiguille Rouge is composed of lias in horizontal strata, being at Portree, I mentioned the fact to M. Necker, who thereupon speedily turned up in his old Alpine notes a section of the Aiguille Rouge clearly expressing the same fact.

and Illyria; yet undertook also researches into the enigmatical fossiliferous deposits of the Tarentaise, to which, about that time, M. Elie de Beaumont had called fresh attention.

I cannot but pause to remark, that had M. Necker resolutely set himself to publish *at that time* his most elaborate and persevering researches on countries even yet so little known to geologists as the Southern and Eastern Alps, he would have obtained a distinguished rank amongst the foremost field-geologists of his day. There is no doubt but that almost to the close of his life he was looking forward to still effecting the publication of what he knew had been too long delayed, yet of which he could not but be aware of the value.

We have now reached the year 1829, when Necker was forty-three years of age, and from this period we may probably trace the commencement of the second and far less happy stage of his life. As one of his attached countrymen observes, in a letter to me, the two phases were so unlike, that they might seem to have belonged to different individuals; the first period marked by the greatest bodily and mental activity, exuberant spirits, and relish for society; the second by comparative indolence, too often by moody reserve, and a painful tendency to misconstrue the kindest intentions of his warmest friends. One of the latter informs me that when he saw him as late as 1824, he was, to use a homely phrase, "blithe as a bee;" and I have no doubt that it was about 1829 that his health began to fail,—partly, one may believe, in consequence of the effects upon a nervous, though wiry constitution, of the very prolonged and laborious pedestrian journeys which he had previously made through countries often inhospitable and sometimes insalubrious. One evidence of the change in his health, was his seeking variety of scene, and a less rigorous winter climate than that of Geneva, by returning once more to his well-remembered Scotland.

My acquaintance with M. Necker commenced at Edinburgh in November or December 1831. The exact date is recalled to me by having first heard from him (then just arrived from London) of the brilliant discoveries which Mr Faraday had communicated to the Royal Society, on the derivation of electric currents from permanent magnets. I can even now recall the spot on which M. Necker first made me acquainted with this grand result. The privilege of making his acquaintance was to me at the time a great

one. His favourite sciences were those which then occupied most of my own attention,—geology, meteorology, and general and terrestrial physics. He was perfectly at home in the Alps, which I had already visited, and to which I was about to return. He was as communicative as I was desirous to learn; and having, at that particular period, my time very much at my own disposal, as he also had, we found many congenial subjects of discourse of which we never tired, and innumerable objects for geological rambles in the neighbourhood of Edinburgh, with which, of course, I was familiar, and which were intimately associated in his mind with the precious lessons which he had drawn from the lips of Playfair and of Hall. In addition to this, many of his early friends were also my own. It may therefore be believed that, with his naturally amiable and communicative disposition, we were not long in becoming fast friends. I may say confidently that with few persons have I spent more delightful hours at any period of my life, or been rewarded by a larger amount of instruction, conveyed with a simplicity and grace which were peculiarly his own. M. Necker's appearance at this time was remarkably prepossessing. He was rather short than otherwise; well proportioned and active; his complexion was dark but ruddy; his eyes, of a fine blue, beamed with intelligence; his nose was aquiline, and the upper and lower parts of the face slightly retreating; the mouth firm but sweet; his gait rapid, nervous, and earnest. He spoke English with the utmost fluency, but with a foreign accent far from disagreeable. He had a keen sense of humour (as may be gathered from Mr Cumming Bruce's early recollections), which never forsook him, and he possessed a stock of natural gaiety which flavoured his conversation even long after he was subject to those fits of melancholy from which, in later life, he suffered so severely.

He left Edinburgh for London in February 1832, where I also passed some time in his society. Later in the same year we met at Geneva, where I experienced his hospitality, and had the good fortune to be introduced to his excellent mother. The same autumn he invited me to join him in a tour through part of Switzerland, including the Oberland and Valais. This pleasant tour lasted for a fortnight, and showed the resources of my friend in many new lights. From the commencement of 1832 until his death, almost

thirty years later, we maintained a correspondence which, though often recurring at long intervals, was not discontinued. By the aid of these letters I can trace some particulars of his migrations, which might otherwise have escaped me.

In 1833 and 1834 he appears to have been much engaged in the preparation of a treatise on Mineralogy, which had for long occupied his thoughts. He spent the winter of 1834-5 in Paris, carrying it through the press. This was M. Necker's most considerable and most systematic work. It shows to advantage the combination of scientific knowledge which he possessed,—which, as I have already intimated, extended over a wide range of subjects, including not only the Natural History Sciences, but Physics and Chemistry. Such a combination is eminently required by the philosophical mineralogist. His science is unfortunately at present cultivated by few, and profoundly studied by hardly any. Had this not been so, Necker's fame would have been more widely spread than it is. In a very remarkable paper, first published in Jameson's Edinburgh Philosophical Journal for 1832, he treated of "Mineralogy as a Branch of Natural History." He showed that a well characterized mineral is to be regarded as an *individual*, and that such individuals are to be grouped under species, genera, orders, and classes, as in the classification of the organic creation, by having a philosophical regard to *the whole* of the characters and properties which belong to the individuals of each species, in the same way as was done by Cuvier for animals, and by Decandolle for plants. His aim was to conciliate as far as may be the hitherto conflicting systems of classification,—that by Chemical properties alone, and that from External characters alone. His doctrine was (in brief) that those chemical characters are most to be regarded which visibly and palpably affect the external features of the mineral individual; that the indications of ultimate chemical analysis are not, correctly speaking, mineralogical characteristics at all; and that, where chemical and external indications are in apparent contradiction (which is rare), the latter are to be preferred.

Necker applied his principles, which he had derived from a large and wide study of Natural History in its most general sense, with very great ingenuity to the distinction and classification of minerals. His system is detailed at great length, and with much clearness

and precision, in his *Regne Mineral, ramené aux Méthodes d'Histoire Naturelle* (Paris, 1835, 2 vols.), to which I have already referred. It is evidently a work conducted with the most patient and conscientious labour. The elaborate tabular views illustrating the system of classification by the totality of the properties on which it is founded, have probably never been exceeded in clearness of detail.

I do not feel entitled to give an opinion as to the success with which Necker applied his principles to the reform of mineralogical classification. But it is admitted by competent judges that he laid down those principles with great success, and in a highly philosophic manner. Dr Whewell in his *Philosophy of the Inductive Sciences*, has devoted almost a whole chapter\* to an analysis of Necker's work, to which he gives high commendation. Professor W. H. Miller, of Cambridge, probably our highest English authority on mineralogy, has expressed to me his approbation both of Necker's paper in the *Philosophical Journal*, and of his larger work. "They indicate," he says, "on the part of the author, a most philosophic mind. His criticisms on preceding classifications are very just."

I think that the labour—both mental and mechanical—of writing and editing this elaborate treatise, so full of minute details, and of discussions (at least in the introduction) of almost metaphysical subtlety, was perhaps greater than the author's then enfeebled health could well support. Necker was never afterwards quite the same man as before. His nervousness increased painfully, accompanied by fits of absence, and excessive love of seclusion. He considered, probably with justice, that the rigorous winters of Geneva aggravated his sufferings, and returning to Scotland, he passed the winter of 1836-7 in Edinburgh. In the summer of 1837 he returned to Switzerland, and made probably his last journey of any length in the Alps. He crossed the Col of Mont Cervin, studying carefully the geology of that wonderful country, and also the southern portion of the mountains separating Grindelwald from the Valais. In 1838 we find him again in Edinburgh, preparing to pass the winter, which he did at Portobello, near Edinburgh, and close to the seaside, where he hired a small house, and lived in almost complete seclusion. I visited him occasionally; but any society was oppressive to him. His windows looked right out upon the sea,

\* *Philos. Ind. Sci.*, book viii. chap. 3. Edit. 1840, vol. i. pp. 500-516.

and he pleased himself by thinking that nothing but the ocean separated him in a right line from Norway. Leaving Portobello in May 1839, he spent part of three months in his old favourite resort, the Isle of Arran. Here he occupied himself with much diligence and zeal in surveying accurately the granitic and trappean formations of the island. The results were presented to the Royal Society of Edinburgh, in April 1840, in an elaborate paper, which embraces a minute tabular description of no less than 149 individual trap dykes in the north-eastern part of the island alone, besides giving indications of many more. It was an occupation well suited to M. Necker's state of health, affording constant, yet moderate occupation of mind, and attraction out of doors, with the advantages of a temperate climate, and removal from any interruption, or anxiety. The wonderful patience and conscientious ability with which this labour was executed is worthy of all commendation; and the really astonishing nature of the phenomena which it chronicles with so much minuteness, exempts it from the suspicion of being a useless or puerile employment. So close a survey introduced M. Necker to many singular mineralogical and geological peculiarities previously overlooked; and having myself since gone over much of the ground with his memoir in my hand, I can testify to its wonderful fidelity. It is impossible to foresee how important this catalogue of dykes may one day prove to the future dynamical geologist.\*

We have an interesting chronicle of Necker's life at this time, in a series of letters to his mother, which were printed soon after in the *Bibliothèque Universelle de Genève*.† They commence at Portobello in February 1839, and they unfortunately terminate in September. These letters, now buried in a large periodical work, are charming in themselves, and give a delightful picture of the writer's capacity for intellectual enjoyment. He always presented to his mother the gayer side of his impressions. The little traits of

\* In this paper (Trans. Roy. Soc. Ed., vol. xiv.), Necker refers with much interest and satisfaction to his discovery of an outbreak of granite to the north of the head of Glencloy, quite detached from the granitic nucleus of Goatfell. Jameson had already noted syenite near this locality. I am not sure whether Necker recollects having cited Jameson's earlier observation in his own *Voyage en Ecosse*, tom. ii. p. 31.

† Tom. xxv., xxvi., for 1839 and 1840.

his daily life are told with characteristic naïveté, and are interspersed in the most natural manner imaginable with a notice of what he saw interesting in botany, ornithology, mineralogy, or upon other scientific topics, which he evidently felt sure would be neither unintelligible nor uninteresting to his correspondent. In quitting Arran, he adds the significant remark, "Je regrette Arran, où je me suis fait un bien prodigieux." The later part of the season he spent in the Orkney and Shetland Islands, interesting to him, as well from the picture of primitive manners which they present, as from their remarkable geology. This part of his tour is detailed in his letters to Madame Necker; and there is a letter to M. Moricand of Geneva on the geology of the Island of Unst, in a subsequent number of the *Bibliothèque Universelle*. From the Shetlands he proceeded to Skye, where he passed the winter of 1839-40. Here he found so much to interest him geologically, and also found the damp but mild climate to suit him so well, that he was gradually led to adopt Portree as his permanent abode.

During his residence in Skye, in the winter of 1839-40, he was, I believe, actively engaged in preparing for the press the first volume of his *Etudes Géologiques dans les Alpes*, of which no other ever appeared.\* He spent the summer of 1840 at Geneva, where the work was no doubt chiefly written. In the autumn he quitted Geneva, with the deliberate purpose of making Portree his future residence. He passed the winter in Paris, seeing his work through the press. I find, from a letter to myself, dated at Edinburgh in April 1841, that Necker was then returning to Skye, having completed the printing of his book, which bears date of 1841.

The *Etudes Géologiques* form the third of Necker's separately published writings. They were probably expected by the author to be, when completed, his best memorial, and the chief contribution to science of a lifetime devoted to its pursuit. But the work as it stands goes but a little way to realise those reasonable hopes. It is but a fragment, and a fragment of which the merits and defects are equally characteristic. We find evidence of patient, clear-sighted investigation into natural operations which would have escaped a less diligent observer, and whose significance a less

\* The work itself includes numerous references to his observations in Scotland made in 1839.

intelligent reasoner might have disregarded. It is professedly confined, for the most part, to the superficial formations, and to the basin of the Lake of Geneva. But the author's turn for discursive illustration of his subject ever tempts him to introduce curious, and sometimes important facts, recorded by him in other countries, and in the older rock formations. The work, in fact, oscillates between a memoir on local geology and a systematic treatise; and it does not exactly fulfil the purpose of either. The innumerable references which it contains to forthcoming parts of the intended work give us good room to regret that Necker had not more strictly followed the course pursued by his grandfather, De Saussure, by publishing his geological observations in the order in which they were made, and interspersing them with those contributions to the other parts of physical geography, and those animated descriptions of scenery, in which he, as well as his illustrious relative, peculiarly excelled.

Even in its present fragmentary form there is much to interest the geologist in the isolated volume of studies which M. Necker has left. The followers of Sir Charles Lyell will find in it a fund of admirable observations on the effect of causes still in action; and although the doctrines of glacial operation have made great progress since 1841; and although Necker was systematically disinclined to side with those who attributed to the formerly vast extension of glaciers conspicuous effects both in and out of Switzerland, his information on the distribution of erratics in the basin of the Lake of Geneva is very interesting and suggestive, and many of the facts and difficulties which he propounds are worthy of great consideration.\*

As the *Etudes sur les Alpes* was the last, not only of Necker's larger and separate, but even (I believe) of his more occasional printed contributions to science, I may as well advert here to one or two of the latter—his detached memoirs—which I have not already had occasion to mention. There are several on subjects of pure mineralogy, perhaps of no great intrinsic importance. There is a paper in the *Transactions of the Royal Society of Edinburgh*,

\* I have elsewhere pointed out (Edin. Review, April, 1842) some errors into which M. Necker fell in treating of the mechanism of glaciers, a subject to which he appears to have given but little attention.

Vol. XII., on the True and Apparent Dip of Strata; and there is a pleasing and somewhat elaborate paper in the second volume of the Genevese Memoirs on the native birds of the district.\* To these I shall merely make this general reference. But I wish to mention three occasional papers, somewhat original in their nature, and which are characteristic of the pleasure which Necker took in cultivating subjects connected with Physical Geography and Natural Philosophy, in an enlarged acceptation, just such as M. Saussure would have relished.

The first of these was an attempt to connect in a general way the great lines of geological stratification over the globe, with the lines of equal magnetic intensity, as traced by Hansteen and General Sabine. This was as early as 1830,† and it is only fair to state, that the knowledge either of the one or of the other class of phenomena was then, at all events, too limited to justify any confident deductions on the subject. The comparison of these lines of direction was not, however, made without considerable research, and the growing interest of the inquiry, and perhaps the increasing probability of its having some physical foundation, induces me to recall attention to Necker's memoir. The recent speculations of Dr Lloyd tend in the same direction, and I think also the observations of MM. Schlagintweit. In Necker's later writings, such as the preface to his *Etudes*, and in his letters to Mad. Necker, we find that he continued to give weight to the theory of the connection of magnetic with geological phenomena.

The next of these papers is contained in a letter addressed to Sir David Brewster, printed in the "Philosophical Magazine" for 1832. It describes a very beautiful optical phenomenon observed by the author in the Alps, when the direct rays of the sun are concealed by a line of forest fringing some rising ground between the spectator and the sun. The outlines of the trees, and even their entire stems, are then seen to shine with a white light of dazzling brilliancy, resembling frosted silver. The effect is not peculiar to

\* The memoir on birds seems to have been also printed separately. Necker's kinsman, M. H. de Saussure, a very competent judge, styles it "charmanté production devenue très rare, trop peu connue à l'étranger, et qui mériterait une nouvelle édition." Its date is 1823.

† Bibl. Universelle, tom. xlivi. 1830.

any season of the year, or to any hour of the day. It is no doubt due to the diffraction or inflection of light acting under rather unusual circumstances, and is the most notable example of the kind to be seen by the naked eye, without any artificial arrangement. I well recollect M. Necker showing me this beautiful appearance in the course of our tour of 1832, and I have often observed it since. The remarkable circumstance is, so far as I recollect, the absence of prismatic colours, which might, however, be anticipated from the infinite variety of dimension of the objects diffracting the light.

The third of these occasional memoirs by M. Necker, having for its subject certain "diverging rays which are seen long after sunset," appeared in the *Annales de Chimie et de Physique* for February and March 1839. It was communicated, I believe, by Arago's request. This paper excited little notice at the time, and is now perhaps nearly forgotten. Yet, though somewhat diffuse in composition, it contains observations and speculations worthy of record. It contains ample and specific descriptions of the second coloration of Mont Blanc, and the exact intervals after sunset at Geneva of the various appearances of illumination presented by the Alps, which have been more vaguely described by several writers. But the more interesting and original part of the paper refers to the production of divergent beams streaking the calm western sky, at a period about 45 minutes after the sun's disappearance. These, no doubt, are most usually caused by detached clouds intercepting the sunlight, and throwing their dusky shadows athwart the vaporous sky. When such is the cause, M. Necker remarked that bad weather usually followed within a short period.\* But he also observed that some of these crepuscular phenomena had a more fixed character, and did not indicate a change of weather; moreover, that they recurred (he thought) as often as the sun set in the same position,—that is, every spring and autumn, especially on certain days of February and October, at Geneva.

Hence he began to entertain the idea that the dark rays were shadows of distant mountains lying westward from the spectator,

\* This is the foundation of the popular phrase applied to the appearance of "the sun drawing water." See Herschel's Astronomy (Lardner's Encyc.), p. 31.

on the horizon of which the sun was situated when the rays appeared. In the special case mentioned, he believed the Monts Dôme, near Clermont, in France, to originate those rays, and he obtained information from various quarters tending to confirm his idea. From having very often conversed with M. Necker on the subject of his "Rayons crépusculaires," I know that for a number of years he gave this curious inquiry his close attention; and he believed, I think, that from Edinburgh he could see the gigantic shadows of the hills of Arran and Jura.

M. Necker was an honorary member of the Wernerian Society of Edinburgh, and of the Geological Society of London. In the *Proceedings* of the latter (vol. i. p. 392, Feb. 1832) is a short abstract of a paper by him, on the Geological Position of Metalliferous Deposits.

Returning now to the history of M. Necker's later years, I may abridge my record of them within a brief compass. We have seen that he returned from Paris (where he had been printing his "Etudes sur les Alpes,") in April 1841, through Edinburgh, to Portree, in Skye. He was there met by the grievous tidings of the death of the mother to whom he had been so deeply attached. This event occurred at Mornex, near Geneva, on the 13th April, precisely two days before he quitted Edinburgh. It must have been sudden and unexpected, or we may be sure that Necker would not have moved northwards had he perceived her health to be failing. It is easy to conceive, though we have no record of its details, the shock which thus fell upon the amiable recluse. Madame Necker was not only the dearest tie which still linked him to his natural home, but in losing her he lost the beneficial outlet to his sympathies which he had ever found in the sustained and intimate correspondence which he held with her, and of which the printed specimens give us so pleasing an impression. From this time he never again revisited his native country, and his habits became more and more recluse. For some years after his great loss he refused to see almost every one who, with the kindest intentions, sought to interrupt his solitude, and he suspended nearly all correspondence. He rambled occasionally over different parts of the Island of Skye, especially

amongst the Cuchullin Hills, and in the environs of Portree and the Storr. But gradually he ceased to absent himself even for a night from home, and confined his excursions within the distance which his pedestrian powers allowed. Once in two or three years, as other engagements permitted, I visited Skye about this period, for the purpose of ascertaining his condition, and of offering such sympathy as he was willing to receive. My friendly overtures were rarely if ever repulsed; and though it was painful to witness the isolation and depression of a person so cultivated and so amiable, there were always intervals in which his old spirits and old interests awoke out of the partial torpor induced by his enfeebled health and monotonous life. Scarcely a day passed during any one of my visits in which we did not walk together to some of the charming localities near Portree, and discuss with renewed interest the scientific problems which his intelligence and quick observation were ever unfolding, whether from the noblest natural object, or the most trivial daily occurrence, in his neighbourhood. It was evidently agreeable to him, even in his sadder moments, to use and listen to his native language, to recall the scenery of his glorious Alps, the achievements and writings of his eminent grandfather, the memory of his accomplished mother, and the cherished reminiscences of his early life in Edinburgh. Nothing was more surprising than to find how few passing events of either public or domestic interest escaped him in his apparent isolation, from which even correspondence was at times almost banished. At this period, however, he read the newspapers with great perseverance, and he seemed never to forget anything that he once read, or to fail in connecting it with what he had previously known. I used to be amazed to find that he occasionally knew more of what was happening in Edinburgh than I myself did; and he tracked with an unfailing instinct the changes which time rapidly produced in the wide connections of his early Scottish friends, many of whom very erroneously believed that he had quite forgotten them. His periodical reading at this time embraced the *Journal des Debats*, the *Caledonian Mercury*, and the *John O'Groats Journal* (a Caithness paper); and from this singular library he managed to extract a wonderful amount of current information, not only public and domestic, but also concerning physical events and changes,

and literary intelligence. Of modern books he read very few, but probably occupied his leisure in reviewing the records of his geological tours, and, perhaps, in extending them for the purpose of future publication. He was a very assiduous observer of Meteorological changes, of which he kept a constant record, and by the aid of his barometer, and his great knowledge of atmospheric effects, his cautions became of the most practical value to the fishing population of Portree, by whom, as indeed by all the islanders, he was regarded with much respect and interest, to which the peculiarity of his manner of life, and his extreme shyness towards persons in his own rank of life, no doubt contributed. The prediction of storms was with him for many years a matter of systematic study, and his warnings were at least as much regarded by the Skye sailors as any which Admiral Fitzroy could now furnish. Indeed, one use which he made of his newspaper studies was to trace, by means of the *Shipping Intelligence*, the progress of gales not only over Britain but to the most distant parts of the Atlantic, and he has often discussed with me the results of these interesting, and far from easy investigations. In other respects also he took a sincere interest in the welfare of his poorer neighbours. His kindness was unpretending, and the extent of his liberality will never be known. It is little to say that it was exercised occasionally in ways peculiarly of his own devising, and that he was sometimes the dupe of designing or unworthy petitioners. But in a country, a portion of whose population may be said to be ever on the verge of destitution, the presence of so generous a friend was a public benefit.

From 1851 the state of my own health made renewed journeys to Skye impossible, and through a most unfortunate accident (which I need not explain) our correspondence was for some years interrupted. Before this, however, the intense gloom supervening upon his mother's death had become, in some measure, dissipated. He no longer rejected the visits of his countrymen, or eschewed correspondence as he had once done. The death of his only brother in 1849 affected him considerably, but led him to welcome the younger relatives, who now almost every summer gladdened his solitary chamber. It is cheering to know that the later years of so good a man were blessed with a revival of domestic interests, from which an invincible melancholy, foreign alike to his original disposition

and his principles, had for a time debarred him. In the only letter from him of at all recent date which I possess,—it was written in 1859, and was evidently the result of considerable physical exertion,—there is pleasing evidence that neither advancing age, nor expatriation, nor twenty years of solitude and of struggle with constitutional depression, had quenched his sympathy with his friends, or his interest in the cause of science. In it I find a touching enumeration of the losses which he had suffered in the rapidly narrowing circle of his Genevese contemporaries and relatives;—I find also expressions of lively sympathy with the younger generation, and their family connections;—ample proofs that during years of silence and seeming forgetfulness, both his earlier and his later friends in Edinburgh, and elsewhere in Scotland, had never long been absent from his thoughts;—and inquiries, made with an almost tremulous anxiety, as to some of those of whom he had had no recent tidings. Especially did his recollection then turn towards the families of Cumming and of Mackenzie, amongst whom there still survived a few of those friends of 1806, with whom he had shared the intellectual and social enjoyments of his first and happiest Scottish sojourn. I venture to give these details, because his friends were not all aware of the warmth and unalterable sincerity of his attachment, to which, unless an opportunity was directly offered through a letter or a visit, he rarely if ever sought to give expression.

At this period, 1859, he was suffering severely from attacks of rheumatism, which confined him almost entirely to the house. Though enjoying tolerable general health, he became more and more of an invalid. I ought here to record, that throughout the whole of his twenty years' residence at Portree, he was lodged in the house of Mr John Cameron, whose attention and kindness he very highly valued. The knowledge of this circumstance relieved materially the anxiety of M. Necker's friends. Nothing in his last illness requires special notice. He sunk gradually through increasing debility, and without pain, and quietly expired at 7 P.M., on the 20th November 1861, in the seventy-sixth year of his age.

*Note on the Family of M. L. A. Necker.*

Since the preceding biography was drawn up, I have received from M. Theodore Necker, nephew and nearest surviving relative of Professor Necker, some genealogical particulars which are of sufficient interest to be here briefly recorded. The family of Necker is stated to have been originally Irish, and to have taken refuge in Protestant Prussia during the religious persecutions of Queen Mary of England. Early in the eighteenth century, Charles Frederic Necker, great-grandfather of the subject of our biography, left Custrin in Pomerania for Geneva, being charged with the education of a young German prince. He was a jurist of eminence, and having determined to settle at Geneva, a chair of law was instituted for him in 1724. He died in 1760. His son Louis Necker was Professor of Mathematics at Geneva, and author of several works, while another son was Jacques Necker, the celebrated financier. These brothers both died in 1804. The former was grandfather of Louis Albert Necker, the subject of our biography, and father of Jacques Necker who in 1785 married the daughter of de Saussure. This Jacques Necker retreated with his family to England during the French Revolution, and after his return became Professor of Botany at Geneva. He was remarkable for his unflinching opposition to the French sway. On the Restoration of the Swiss Government he was named one of the first magistrates of Geneva, and died in 1825, very highly respected and regretted. Besides Louis Albert Necker, his eldest son, he had another, Theodore, and two daughters.

Hence the subject of this notice was Professor at Geneva in the fourth generation.

M. Theodore Necker (the nephew of my friend) informs me that among his uncle's papers there remains nothing like a completed work, and little that is available for publication. Through the kindness of the same gentleman, the minerals collected by M. Louis Necker during his residence in Scotland have been presented to the University of St Andrews.

I ought, perhaps, to add (on the authority of M. de Candolle) that the long delay which occurred in the publication of Necker's *Voyage en Ecosse*, to which I have adverted in the preceding notice,

was in part due to the detention of his papers in Scotland until after the peace of 1815.

I have been indebted for some valuable information respecting M. Necker's earlier history to the kind communications of Professor Alfred Gautier, a distant connection and attached friend of the subject of this biography.

2. On the Structure and Optical Phenomenon of Decompressed Glass. By Principal Sir David Brewster.

3. Notes on the Anatomy of the Genus *Firola*. By John Denis Macdonald, R.N., F.R.S., Surgeon of H.M.S. "Icarus." Communicated by Professor Maclagan.

These notes are intended to form an appendix to the author's paper on the anatomy and classification of the Heteropoda, read before the Society last session. He finds the relationship between *Firola* and *Firoloides* even closer than he had supposed, and that, with the exception of gills in the former genus, nearly every anatomical point occurring in one, may be distinctly traced out in the other, only differing in relative characters. The author describes in detail the anatomy of *Firola*, illustrating his description by a drawing. He concludes this notice by stating his now confirmed conviction of the separation of the sexes in the Heteropoda, of some of which he had obtained specimens which were indubitably females; and he states, in reference to the male sexual organs—as the result of the examination of some hundreds of Heteropoda—that the vas deferens is never traced onwards to the external male organ, but that the penis is imperforate as in many of the Gasteropoda, is far in advance of the spermatic opening, and that these structures are held in communication by a ciliated groove, capable, more or less, of being converted into a canal.

4 On the Zoological Characters of the living *Clio caudata*, as compared with those of *Clio borealis* given in Systematic Works. By John Denis Macdonald, R.N., F.R.S., Surgeon of H.M.S. "Icarus." Communicated by Professor Maclagan.

The object of the author in this paper is to prove the importance

of examining, in the living and expanded state, all soft, collapsible, and contractile animals. He describes in detail the anatomy of the genus *Clio*, illustrating his description by a drawing. He points out the confusion that has occurred in systematic works between the species named respectively *Clio borealis* and *Clio australis*; and he describes characters by which he thinks that these two species ought to be separated from *Clio caudata* and erected into a new genus; which, however, he declines to designate, being averse to add new names to a list already large.

The following Gentlemen were admitted Ordinary Fellows of the Society:—

EDWARD MELDRUM, Esq.

The Right Hon. CHARLES LAWSON, Lord Provost of Edinburgh.

JAMES HANNAY, Esq.

ALEXANDER PEDDIE, M.D.

The following Donations to the Library were announced:—

Transactions of the Royal Society of Victoria. Vol. V. 8vo.—  
*From the Society.*

The Canadian Journal of Industry, Science, and Art, November 1862. 8vo.—*From the Institute.*

The Journal of Agriculture, January 1863. 8vo.—*From the Highland and Agricultural Society.*

The Journal of the Chemical Society, January 1863. 8vo.—*From the Society.*

The Cultivation of Cotton in Italy: Report by G. Devincenzi, Member of the Italian Parliament. 8vo.—*From the Author.*

Notices of the Proceedings of the Royal Institution of Great Britain. Part XII., 1861, 1862. 8vo.—*From the Institution.*

Royal Institution of Great Britain, 1862. A list of the Members, Officers, &c., for 1861. 8vo.—*From the same.*

Proceedings of the Royal Society of London. Vol. XII., No. 52. 8vo.—*From the Society.*

Journal of the Asiatic Society of Bengal. No. CXII. 8vo.—*From the Society.*

Journal of the Statistical Society of London, December 1862. 8vo.—*From the Society.*

Transactions of the Linnean Society. Vol. XXIII., Part III.

4to.—*From the Society.*

Magnetical and Meteorological Observations made at the Government Observatory, Bombay, in the year 1860, under the Superintendence of Lieutenant E. F. T. Fergusson, I.N., &c., and Lieutenant P. W. Mitcheson, I.N. 8vo.—*From Her Majesty's Government.*

Compte Rendu de la 45<sup>e</sup> Session de la Société Suisse des Sciences Naturelles, réunie à Lausanne les 20, 21, et 22 Août 1861.

8vo.—*From the Society.*

Neue Denkschriften der Allgemeinen Schweizerischen Gesellschaft für die Gesammten Naturwissenschaften. Band XIX. 4to.—*From the same.*

Annales de l'Observatoire Physique Central de Russie, publiés par ordre de sa Majesté Imperiale, par A. T. Kupffer. Nos. 1 & 2 (Année 1859). 4to.—*From the Russian Administration of Mines.*

Cercles Chromatiques de M. E. Chevreul. 4to. *From the Author.*

Mémoires de l'Institut Imperial de France. Tome XXXIII. 4to.

—*From the Academy of Sciences.*

Supplément aux Comptes Rendus hebdomadaires des Séances.

Tome II. 4to.—*From the same.*

Mémoires présentés par divers savants à l'Academie des Sciences, Tomes XVI. et XVII. 4to.—*From the same.*

Carte Géologique des Parties de la Savoï, du Piémont et de la Suisse voisines du Mont Blanc, par Alphonse Favre, Professor de Géologie à l'Academie de Genève.—*From the Author.*

*Monday, 19th January 1863.*

His Grace the DUKE of ARGYLL, President,  
in the Chair.

The Council having awarded the Makdougall-Brisbane Prize, for the biennial period ending November 1862, to Dr William Seller, for his "Memoir of the Life and Writings of Dr Robert Whytt," printed in the Transactions, the Prize was presented to Dr Seller by the President.

The following Communications were read:—

1. Notes on the Geology of Lüneburg, in the kingdom of Hanover. By the Rev. Robert Boog Watson.

Lüneburg is the capital of the old Hanoverian duchy of the same name. It stands on the small navigable river Ilmenau, about thirty miles S.E. from Hamburg, and about 150 feet above the sea. The country around is a flat sandy heath, from which the gypseous limestone rock of the Kalkberg rises, not unlike Dumbarton Castle, to a height of 180 feet above the plain. The strata which here present themselves are—

1. Recent sea sand.
2. Boulder sand, sometimes 100 feet thick, full of boulders large and small, of gneiss, chalk, flints, flint-fossils, and great lumps of amber.—Absent from the site of the town and from the Kalkberg, but present at elevations in the neighbourhood considerably greater than either. Lüneburg was not therefore, as it has been described, "a Helgoland in the Boulder Clay sea." (Roth. Zeitschrift der Deutschen Geol. Gesell. 1860.)
3. Miocene clay, with fossils, sometimes from 200 to 300 feet thick.—It rests unconformably on the chalk; but within the town, and round the Kalkberg, where the chalk is absent, it lies directly on the gypsum. It has not been disturbed by intrusion from below, as the underlying strata have been, but its upper surface has been violently torn and abraded during the Boulder Clay period. It often crops out through the overlying sands, and its presence is generally indicated by fine woods of forest trees.
4. Upper white chalk, with flints and characteristic fossils.—Absent from the site of the town and around the Kalkberg, but spreading out all around, appearing on the surface, however, only in one patch on the north side of the town.
5. Triassic clays, limestones, and shales, with fossils.—Present on the surface only in a patch west of the chalk, and intermediate between the chalk and the Kalkberg, but found below the surface in a thin layer over the entire site of the town, and further met with wherever borings have been made through the chalk.
6. Gypsum and anhydrite.—Found wherever borings have been

made sufficiently deep. In the Kalkberg and the Schildstein, a hillock to the west of the Kalkberg, they have penetrated the surface. In general, the gypsum forms but comparatively a thin skin over the unaltered anhydrite; but in the Kalkberg, the whole mass of the rock, which has been quarried to the very heart, is gypsum. The gypsum and anhydrite are a good deal like one another; resemble marble; compact, greyish-white in colour, and slightly translucent. The gypsum especially is full of fissures, one of which has been followed 130 feet deep, filled with dolomite; more commonly they are filled with a gypseous breccia, which in one of the fissures contained the bones of a recent bat (*Vespertilio noctula*). These fissures produce a false appearance of vertical bedding. The crystal Boracite is found in the gypsum and anhydrite. It is only found elsewhere in the precisely similar gypsum rock of Alsberg, at Segeberg in Holstein. Non-crystalline, it appears in the Keuper gypsum of Lüneville in France.

No fossils exist.

The gypsum forms an anticlinal axis, with the Kalkberg for its highest point, sinking away to the east under the town in the form of a narrow round-backed bank, which dips steeply to north and south. Associated with the anhydrite are brine springs almost at saturation point, coming to judge by their temperature from a depth of 400 or 500 feet. These have so exhausted the under surface that great subsidences have occurred.

The points of geological interest connected with this locality are:—

I. That it is far the most instructive, and indeed almost the only place in the great flat of Northern Germany, where the underlying strata have been brought to the surface, these being generally buried deep under sand and clay.

II. That there is here an exhibition of a very peculiar agency by which these strata were elevated, and of the time when this occurred.

One of these inferior strata is anhydrite, a sulphate of lime deposited from water, but deposited without water of crystallization entering into its formation. Later, through exposure to moisture, it has accepted water into chemical combination with the sulphuric acid and lime, and thus changing to gypsum, has expanded to a

bulk more than one-fourth greater than before, an increase nearly four times as great as that of water in freezing. This expansion, prevented from developing itself freely, has accumulated at the point of least resistance, and forced up the Kalkberg just like the plug of ice which rises through the fuse-hole of a mortar-shell when filled with water and frozen.

The origin of the sulphuric acid cannot be traced. Heat, pressure, and strong brine have all been proved sufficient to effect the deposition of the sulphate of lime in an anhydrous state.

The expansion through metamorphism must have occurred after the deposition of the chalk, and before that of the miocene clay, the chalk having been disturbed, and the clay thrown down on it after its disturbance.

III. That the age of these gypseous and saline deposits, though a difficult question, can be determined.

No borings have been carried through the anhydrite to show on what it rests. Evidence of age therefore lies in the fossils of the overlying strata, which, resting on the gypsum, have been brought up along with it. These strata are minute in extent, but abound in fossils—chiefly casts. They indicate the Upper Trias, but the particular member of it to which the beds are to be assigned has been keenly debated. Very recently, however, the discovery of five specimens of *Ceratites nodosus* have, in connection with the rest of the evidence, and especially as associated with *Myophoria pes anseris*, given the preponderance in favour of the Lettenkohl. This is a subordinate formation now admitted to exist; but whether to be ranked as the highest of the Muschelkalk or the lowest of the Keuper, or a transition link between the two, is doubtful. Its flora connects it with the Keuper, its fauna with the Muschelkalk. In the Lüneburg beds no vegetable remains have been found, and the want of these renders the relation of these beds to the Keuper more obscure. The absence of such vegetable remains is indeed a characteristic of the Muschelkalk; but this is but a negative resemblance, and its force is counteracted by the absence in the Lüneburg beds of such distinctive fossils of the Muschelkalk as the *Encrinites liliiformis*, *Nautilus bidorsatus*, *Terebratula vulgaris*, &c.

The question then must be determined by the *Myophoria pes anseris* and the *Ceratites*, both of them interesting in themselves

from their facility of recognition and from their very limited range in time. The genus *Myophoria* is confined to the Trias, and the two deep teeth at the hinge in either valve make it easily recognisable from the *Trigonia*, which has three teeth. The species *Pes anseris* is ribbed, so as exactly to resemble the foot of a goose. It does not last on into the Keuper; it has just barely begun to appear in the latest strata of the Muschelkalk; it abounds in almost incredible numbers in the intermediate Lettenkohl. Now at Lüneburg, the limestone is almost made up of it alone, so abundant is it. This fact therefore connects these beds with the Lettenkohl.

The *Ceratites nodosus* confirms this conclusion. The entire genus is confined to the Trias.\* It forms a link both in form and in time between the expiring goniatites and the yet future ammonites. The *Ceratites nodosus* may be very easily recognised by the characteristic feature of the genus, which is, that in each septum all the lobes which point in towards the interior of the shell are toothed, while the projecting rounded saddle between each two lobes is smooth. The species *nodosus* is marked by thick ribs on the sides, radiating outwards, and terminating just at the edge of the back in high knobs or knots; whence its name. The projection of these knobs being on the side of the shell, the back is rendered unusually broad, and has a very square appearance. Minute variations are very frequent, but are not sufficient to constitute more than mere varieties, and the general marks mentioned are unfailing.

The *Ceratites nodosus*, then, thus easily recognised, is confined to the narrowest limits, as it first appears in the upper strata of the Muschelkalk, and disappears finally and for ever in the Lettenkohl, without so much as reaching the Keuper. Wherever found, therefore, it stamps the strata with one of the most definite assay-marks of science; and such was the importance attached to its discovery in the Lüneburg strata, that Von Strombeck, the great Triassic authority of northern Germany, in the absence of the solitary specimen discovered, but unfortunately lost, refused to believe in its existence. Since then, however, five other specimens have been found. They are mere casts, and but broken fragments of an inch or two

\* It disappears wholly in the Jurassic, but reappears in a few species (four or five) in the Cretaceous. See Pictet, "Paléontologie," vol. ii. p. 662. This is therefore an exception to the absoluteness of what is stated above.

in length, and, as is so often the case with ammonites, seem to have lain long in the water after the death of the animal. They have, however, the distinct characteristics of the *Ceratites nodosus*.

These specimens have been the more carefully examined, and the inferences deducible from them the more keenly discussed, from the fact that they have been thought to offer some support to the Darwinian theory of transformation. Von Strombeck and others believe that the latest generations of the *Ceratites nodosus*, as exhibited in the highest strata of the Muschelkalk elsewhere, show a progressive tendency to a certain aberration from the earlier type, as figured by Von Buch in his monograph "über Ceratiten." This aberration, though marked, is not sufficient to constitute, but may be represented as a step towards, a new species. The Lüneburg specimens present this aberration in its widest form, while still obviously belonging to the species *nodosus*. If, therefore, the beds in which they are found can be attributed to the Lettenkohl, then a greater lapse of time is secured. To this lapse of time the change of form may be assigned, and thus some colour may be found for attributing to this same cause the whole of those minute changes of form which the successive species of ceratites present, and which so completely link them on at either end with the antecedent goniatites, and the succeeding ammonites.

As to the question of form. The Ceratites of Lüneburg differs from that figured by Von Buch in this, that in the latter the knobs on the side are included in the first lobe, while in the Lüneburg specimens the back is so much broader that the first lobe fails to reach so far as the knobs, and the second saddle is as it were drawn off the side towards the back, and it therefore, instead of the first lobe, thus includes the knobs. Von Buch's drawings, however, though otherwise most careful, and in this case professedly made from the same specimen, do not agree with one another (see "über Ceratiten," Plate I. fig. 1, and Plate II. fig. 1.) in this very respect of the relation of the knobs to the lobes and saddles; and so, in regard to this particular point, nothing can be made of them. Further, it appears that in all young specimens the back is relatively narrow, and the first lobe extending round the corner of the back at that period of life reaches the knobs on the side; but invariably, as the shell increases with age, the back becomes relatively

broader, and then it is only the second saddle instead of the first lobe which includes the knobs. The only peculiarity then of the Lüneburg specimens is precisely what in other cases would be called a dwarfing—i.e., the signs of age appearing in connection with smallness of size; which fact, taken in connection with the rarity of this fossil in the Lüneburg beds, probably points to the existence of climatic or other circumstances unfavourable to the life of this cephalopod.

The other question, that, namely, of the lapse of time,—in other words, whether the Lüneburg strata are Lettenkohl or not,—must be settled on its own merits. Admitting the Lettenkohl as a distinct subordinate formation later than the Muschelkalk, then it appears that the *Myophoria Pes anseris* is rare in the Muschelkalk, abundant in the Lettenkohl, and abundant at Lüneburg; its evidence therefore points to the identity of the Lüneburg strata with the Lettenkohl. On the other hand, the *Ceratites nodosus* is frequent in the Muschelkalk, but hitherto unknown in the Lettenkohl; its evidence therefore, unlike the other, rather connects the Lüneburg beds with the Muschelkalk. In other words, the *Myophoria Pes anseris* proves that these strata are not Muschelkalk but Lettenkohl, while the *Ceratites nodosus* shows that they lie nearer the Muschelkalk than any Lettenkohl strata yet found.

As regards the underlying gypseous limestone, this conclusion determines its age as greater than that of part of the Lettenkohl. That it is much older is not likely; and the existence elsewhere in the Lettenkohl of similar formations, accompanied as here by salt, indicates that the Kalkberg of Lüneberg belongs to the Upper Trias, and probably to the Lettenkohl itself.

Curiously enough, this conclusion dissociates Lüneburg from Germany, where the Lettenkohl is not at all, or but very slightly, saliferous,—the saline deposits of Germany being found in the lower Muschelkalk,—and connects it with France, Switzerland, and England, where it is in the Lower Keuper distinctively that salt is richly present.

2. On the Occurrence of Stratified Beds in the Boulder Clay of Scotland, and on the Light which they throw upon the History of that Deposit. By Alex. Geikie, Esq., F.G.S.

The following Gentlemen were admitted Fellows of the Society:—

The Right Hon. LORD DUNFERMLINE.

WILLIAM JAMESON, Esq., Surgeon-Major H.M. Bengal Medical Staff,  
and Superintendent of the Botanic Garden, Saharunpore.

WILLIAM BRAND, W.S.  
MURRAY THOMSON, M.D.

The following Donations to the Library were laid on the Table:—

Monthly Report of the Births, Deaths, and Marriages registered in  
the Eight Principal Towns of Scotland, December 1862. 8vo.

—*From the Registrar General.*

Quarterly Report of the Meteorological Society of Scotland. 8vo.  
*From the Society.*

Abstracts of the Proceedings of the Geological Society of London.  
Nos. 88, 89, and 90.—*From the Society.*

Transactions of the Royal Scottish Society of Arts. Vol. VI.,  
Part II. 8vo.—*From the Society.*

Monthly Notices of the Royal Astronomical Society. Vol. XXIII.,  
No. 2. 8vo.—*From the Society.*

Proceedings of the Royal Horticultural Society. No. I., 1863. 8vo.  
—*From the Society.*

Proceedings of the Royal Society. Vol. XII., No. 52. 8vo.—*From  
the Society.*

Transactions of the Botanical Society. Vol. VII., Part II. 8vo.  
—*From the Society.*

The Assurance Magazine, &c., January 1863. 8vo.—*From the In-  
stitute of Actuaries.*

The North Atlantic Sea-bed: comprising a Diary of the Voyage  
on board H.M.S. Bulldog in 1860. By G. C. Wallich, M.D.,  
&c. Part. I. 4to.—*From the Lords Commissioners of the Ad-  
miralty.*

Mémoires de la Société de Physique de Genève. Tome XVI.,  
Seconde Partie. 4to.—*From the Society.*

Annual Report of the Board of Regents of the Smithsonian Insti-  
tution for 1860. 8vo.—*From the Board of Regents.*

*Pinetum Britannicum, a Descriptive Account of all Hardy Trees of the Pine Tribe cultivated in Great Britain, with Facsimiles of the original Drawings made for the work. Part I. *Picea nobilis.* By Messrs Lawsons and Son.—Presented by the Right Hon. Charles Lawson, Lord Provost of Edinburgh.*

*Monday, 2d February 1863.*

The Hon. LORD NEAVES, Vice-President, in the Chair.

The following Communications were read:—

1. On the Influence of Weather upon Disease and Mortality.  
By R. E. Scoresby-Jackson, M.D., F.R.S.E., F.R.C.P.,  
Lecturer on *Materia Medica* and *Therapeutics* at Surgeons' Hall, Edinburgh.

In the early part of this paper the author adverts to the antiquity of researches into the causal relations of health and mortality. Nevertheless, long as these have been the subject of inquiry, the literature of medical meteorology is meagre in the extreme; and in proportion to the time and labour bestowed upon the many other branches of medical science, this department may justly be regarded as having met with unmerited neglect. Reference is made, however, to the names of many eminent physicians, whose researches into the influence of weather upon the human constitution have contributed not a little to adorn the medical literature of the present century.

It is well known that the influence of external agencies upon health differs materially with locality, so that the author feels himself at liberty to make such investigations into the subject of his paper as he may think sufficient to ascertain approximately the relationship subsisting between the weather and mortality in Scotland, without particular reference to the works of authors on kindred subjects in other countries. It is quite possible that the results evoked by Casper in Berlin, Quetelet in Brussels, Boudin in Paris, Emerson in Philadelphia, Farr or Guy in London, and by Stark in Edinburgh, may differ widely in many of the leading features of the inquiry, and yet the inferences of each be correct in

themselves. The author therefore believed that it would be much more to the interest of science to pursue his researches independently of all previous inquiry, divesting himself of all foregone conclusions, and making the facts which he has collected speak for themselves. By following this plan he derives two advantages: *firstly*, that of avoiding a tedious recapitulation of the facts and deductions to be found in other works; and, *secondly*, that of drawing an unbiassed opinion upon the subject, which may the more confidently, on that account, be employed in comparison with results obtained in other localities.

The difficulties attending inquiries into the influence of weather upon mortality are manifold and intricate. All other causes, to which might, altogether or in part, be due the facts observed, must be abstracted and carefully weighed before the true balance of meteorological influence can be justly ascertained; and when this is done, there still remains a deduction to be made for error arising from the unequal distribution of meteorological phenomena even over an area so limited as that of a single city. Whether dependence can be placed upon the accuracy of the returns of the causes of death made to the Registrar-General is another question of serious importance in such investigations. These and many other obstacles arise to bar logical exactness; but where the aim is simply to obtain an approximate knowledge of the subject, the author believes his data are abundantly accurate.

The meteorological data are taken from the collected returns from all the stations of the Meteorological Society of Scotland, as reduced by the Astronomer-royal. The stations have a mean latitude of  $56^{\circ} 30' N.$ , mean longitude of  $3^{\circ} 4' W.$ , and a mean elevation of 222 feet nearly.

The mortality tables are constructed from the returns made by the Registrar-General for Scotland respecting the eight larger towns. The period over which the investigations extend is six years—namely, from 1857 to 1862 inclusive. The meteorological data did not admit of extension over a longer period. The author regrets that he is unable to include ozone and electricity in his investigations. With respect to electricity, he has no data applicable to the places and period under examination; and with reference to ozone, he submits, that until the chemistry of that subtle agency

is better established, its influence upon the human frame cannot be determined. The grand total of deaths from all causes under consideration during the six years was 143,249, and the average population 867,313. The corrected population for each year is employed as the standard of reference for each year's mortality. The inquiry is led into the influence of weather upon mortality from individual diseases, and the several classes of disease, as well as into the mortality from all causes. A detailed account of the inferences deduced by these investigations would involve the reproduction of a series of tables and diagrams for which the Society's Proceedings are not available, and all of which will be found in the extended paper.

## 2. History of Popular Literature, and its Influence on Society. By Wm. Chambers, Esq., of Glenormiston.

Having introduced the subject, Mr Chambers referred to the earliest examples of popular literature in the reign of Elizabeth; they were embellished with wood engravings, believed to be executed in Germany. Such was the origin of those very curious tracts known as "chap books," now very rare, and much prized by bibliographic amateurs. The subjects of these books resembled the Folk-Lore of the Germans, and were the embodiment of the superstitions, fancies, and traditions of a much earlier period; the least exceptionable being the ballads of a heroic and tender kind. Next was traced the rise of newspapers, and the importance they began to assume in the reign of Queen Anne, a period also signalised by the popular writings of Steele, Addison, and Defoe. The imposition of the stamp-duty in 1712 checked this sudden rise of popular literature; and various circumstances postponed its reappearance until the reigns of George IV. and William IV., by which time great advances had been made in education and in a general taste for literature,—the writings of Cowper, Burns, Campbell, Wordsworth, Scott, Byron, and others, along with the influence of certain reviews and magazines, having latterly given much impetus to thought. Mr Chambers then spoke of the origin of Chambers' Journal in February 1832, the Penny Magazine in the subsequent March, and other cheap prints, devoted in an especial manner to popularise

literature. Finally, he drew attention to the abolition of fiscal duties on the products of the press,—the prodigious copiousness of cheap popular sheets, cheap newspapers included,—and the capacity of modern machinery, moved by steam-power, for their rapid production. On investigation, he found that only a small proportion of the whole was of an immoral, or otherwise objectionable kind; much of the writing in this popular department of literature being by authors of repute, to whom large sums were paid for their services. He estimated that there were not fewer than three hundred millions of newspapers now circulated per annum in the United Kingdom; while the quantity of cheap literary sheets issued per annum amounted to 144,000,000. He concluded by referring to the highly improved tone in all departments of the press, not the least of the beneficial effects of modern popular literature being the extinction of what was worthless and pernicious. On concluding his paper, Mr Chambers laid on the table a quantity of copies privately printed for distribution among the members present.

The following note from Principal Sir David Brewster was read by Professor Tait:—

“ I send you, for the Royal Society, six of my best specimens of Decomposed Glass. In presenting them, perhaps you might mention the disappearance of all colour, by introducing a drop of water, and the passage of a prismatic line over each film, owing to the water entering more quickly between some of the elementary films than between others. These may be found by using a balsam that will quickly indurate.”

The following announcements were made from the Chair:—

1. The Council have awarded the Neill Prize for the Triennial period 1859-62 to Robert Kaye Greville, LL.D., for his contributions to Scottish Natural History, more especially in the department of Cryptogamic Botany, including his recent papers on Diatomaceæ.

2. The Council have resolved that a *Conversazione* shall take place in the Society's room, on Wednesday, 25th February, at 8 p.m.

The following Gentlemen were elected Fellows of the Society:—

JOHN YOUNG, M.D., Assistant Geologist, Geological Survey of Great Britain.

DAVID PAGE, Esq., F.G.S.

The following Donations to the Library were announced:—  
 Essays from the “Quarterly Review.” By James Hannay, Esq., F.R.S.E., Author of “Satire and Satirists,” &c. 8vo.—*From the Author.*

Sitzungsberichte der königl. bayer. Akademie der Wissenschaften zu München. 1862. I. Heft 4, und II. Heft 1. 8vo.—*From the Academy.*

Bulletin de la Société Impériale des Naturalistes de Moscou. Année 1861. Nos. I., II., III., et IV. 8vo.—*From the Society.*

The Journal of the Royal Dublin Society, Nos. 26, 27, 28. 8vo.—*From the Society.*

Historical Sketch of Popular Literature, and its Influence on Society. By Wm. Chambers, Esq. of Glenormiston.—*From the Author.*

*Monday, 16th February 1863.*

DR CHRISTISON, Vice-President, in the Chair.

The following Communications were read:—

1. Sketch of the Recent Progress of Sanskrit Literature. By John Muir, D.C.L., LL.D. (This Paper was given at the request of the Council.)

After giving a sketch of the first beginnings of these studies in India, and their further prosecution in Europe, the author adverted to the relations of Sanskrit with the Greek, Latin, and Teutonic languages, and showed how this affinity established the common origin of the nations by which these languages have been spoken. He then proceeded to give an account of Indian literature, commencing with the hymns and other constituent parts of the Vedas, and then proceeding to the principal systems of Indian philosophy,

of which he furnished an outline. He then gave a short statement of the rise and progress of Buddhism, and concluded by merely referring to the later developments of Indian religion and literature, and to the versatility of the Indian intellect as evinced by the variety of its literary productions.

2. On a Pre-Brachial Stage in the Development of *Comatula*, and its importance in Relation to certain Aberrant Forms of Extinct Crinoids. By Professor Allman.

The author described a stage in the development of *Comatula* subsequent to the free stage of the larva, and anterior to that in which it acquires arms. He believed that the subject of the paper was of much interest in affording a key to the nature of certain aberrant forms of extinct *Crinoidea*, such as *Haplocrinus*, *Stephanocrinus*, &c., for the peculiarities of these genera were for the most part exhibited in the young *Comatula*, where they admitted of an easy determination as elements in the composition of the Crinoid.

The following Gentlemen were admitted Fellows of the Society:—

J. G. WILSON, M.D., F.R.C.S.E.  
JAMES MATTHEWS DUNCAN, M.D.  
GEORGE R. MAITLAND, W.S.  
W. DITTMAR, Esq.

The following Donations to the Library were announced:—

Explication de la Carte Geologique des parties de la Savoie, du Piémont, et de la Suisse. Par A. Favre. 8vo.—*From the Author.*

Report of the Commissioners of Patents for the year 1861. Agriculture. 8vo.—*From the American Government.*

Library Catalogue of the Royal College of Physicians. 4to.—*From the College.*

Transactions of the American Philosophical Society. Vol. XII., Part II. 4to.—*From the Society.*

Sitzungsberichte der königl. bayer. Akademie der Wissenschaften zu München. 8vo.—*From the Academy.*

Proceedings of the Royal Society. Vol. XII., No. 53. 8vo.—  
*From the Society.*

Proceedings of the Royal Geographical Society of London. Vol. VII., No. 1. 8vo.—*From the Society.*

Journal of the Chemical Society. February 1863. 8vo.—*From the Society.*

Victorian Exhibition, 1861. Report on Class III.: Indigenous Vegetable Substances. 8vo.—*From the Government.*

Tenth Annual Report of the Trustees of the Public Library, Boston. November 1862. 8vo.—*From the Trustees.*

Annual Report of the Geological Survey of India for 1861–62. 8vo.—*From the Government.*

Proceedings of the American Philosophical Society. Vol. IX., No. 67. 8vo.—*From the Society.*

Proceedings of the Royal Horticultural Society. February 1863.—*From the Society.*

Memoirs of the Geological Survey of India. 4to.—*From Dr Oldham.*

Memoirs of the Geological Survey of India. II. 1 and 2. 4to.—*From the same.*

Geschichte der Physischen Geographie der Schweiz. Von B. Studer. 8vo.—*From the Author.*

Natuurkunde Verhandelingen van de Hollandsche Maatschappij te Haarlem. XVII. Deel, and XIX. Deel, Eerste Stuk. 4to.—*From the Association.*

Preisschriften gekrönt und herausgegeben von der fürstlich Jablonowski'schen Gesellschaft zu Leipzig. 4to.—*From the Society.*

The American Journal of Science and Arts. No. 102. 8vo.—*From the Conductors.*